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EXAMINER	
HSU, JONI	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/729,684	HONG ET AL.	
	Examiner	Art Unit	
	Joni Hsu	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-10 and 12-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-10 and 12-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 20, 2007 has been entered.

Response to Arguments

2. Applicant's arguments with respect to claims 1, 3-10, and 12-26 have been considered but are moot in view of the new ground(s) of rejection.

3. Applicant's arguments, see pages 14-23, filed March 5, 2007, with respect to the rejection(s) of claim(s) 8-10, 21, 23, 25, and 26 under 35 U.S.C. 102(b) and claims 1, 3-7, 12-20, 22, and 24 under 35 U.S.C. 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Voorhies (US007023437B1).

4. Applicant argues that in the presently claimed embodiments, only a very limited portion of graphics data comprising location-related data is passed into the pipeline for each pixel in a given primitive on the first pass. While Gannett (US006118452A)

performs processing on only a limited number of fragments, all the graphics data associated with each fragment is passed down so that it is available in the event that normal operations are to be performed. Gannett does not appear to make a distinction between what graphics data is passed during the first time and the second time (pages 14-15).

In reply, the Examiner agrees. However, new grounds of rejection are made in view of Voorhies.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1, 4, 5, 7-9, 13-15, 17, 19-21, and 23-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Voorhies (US007023437B1).

7. With regard to Claim 1, Voorhies discloses a multi-pass method of rendering a plurality of graphic primitives (*multiple-pass rendering*, Col. 2, lines 58-67; *primitive*, Col. 6, lines 28-29) comprising in a first pass: passing only a limited portion of graphic

data for each primitive through a graphic pipeline, wherein the limited portion of graphic data comprises location-related data (*first portion of the graphics data is read during the first pass, the first portion of the graphics data includes position information*, Col. 3, lines 16-31). According to the disclosure of this application, a compressed z-buffer effectively provides condensed depth information for multiple pixels, such that a grouping of pixels (or a macro-pixel) may by trivially accepted if all pixels of a current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all pixels of the current macro-pixel primitive are deemed to be behind previously-stored pixels [0023]. Voorhies discloses that a macro-pixel (16x16 pixel region) may be trivially accepted if all the pixels of a current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all the pixels of the current macro-pixel primitive are deemed to be behind previously-stored pixels (*coarse rasterizer processes tiles at a first size (16x16 pixel region), such processing includes z-value culling, thereafter, the coarse rasterizer sends an output of such processing to the normal rasterizer which processes tiles at a finer size, tiles that are culled during processing with the coarse rasterizer may be skipped during processing with the normal rasterizer*, Col. 54, lines 44-55; *z-buffer tiling hierarchically on NxN regions using a z-pyramid having NxN decimation from level to level to store the depths of previously rendered polygons, at each cell encountered during hierarchical tiling, conservative culling is performed by comparing the z-pyramid value to the depth of the plane of the polygon*, Col. 6, lines 1-14). Therefore, Voorhies discloses processing the limited portion of graphic data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (Col. 54, lines 44-55; Col. 6,

lines 1-14). The record for each fragment includes a coverage mask indicating the image samples covered by the fragment, and this record format is designed to resolve visibility at each image sample (Col. 33, lines 42-49). Therefore bits on the coverage mask are set to indicate whether image samples in the primitive are visible or not, and this is considered to be setting a visibility indicator, for each primitive, if any pixel of the primitive is determined to be visible. In a second pass: for each primitive, determining whether the associated visibility indicator for that primitive is set; discarding, without passing through the graphic pipeline, the primitives for which the associated visibility indicator is not set; passing the remaining portion of graphic data for each primitive determined to have the associated visibility indicator set (Col. 54, lines 44-55; *after updating the coverage mask, the "potentially visible" samples on the polygon being processed are known, if this mask is null, all samples on the polygon are culled and it is not necessary to update the near z-value*, Col. 46, line 61-Col. 47, line 4; *second portion of the graphics data are read during the second pass, such graphics data in the second portion may include color information, texture coordinates, and color-related state information*, Col. 3, lines 16-35). A multi-level z test is performed, and the test continues to proceed to another level until the finest level is reached (Col. 16, lines 1-22). Therefore, Voorhies discloses performing a two-level z test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of an associated macropixel are

visible (Col. 54, lines 44-55; *at the finest level of the z-pyramid, cells correspond to depths at pixels*, Col. 6, lines 39-43; Col. 16, lines 1-22). Visible geometry is rendered (Col. 5, lines 50-53), and the rendering includes shading (Col. 6, lines 15-17), and therefore Voorhies discloses communicating data associated with pixels of macropixels determined to be visible to a pixel shader for rendering.

8. With regard to Claim 4, Voorhies discloses that each compressed z-record (Col. 54, lines 44-55) comprises a minimum z value for the plurality of pixels, a maximum z values for the plurality of pixels (*finest level of the z-pyramid is a z-buffer containing the depth of the nearest primitive, and the other levels contain zfar values, indicating the depths of the farthest depth samples in the z-buffer*, Col. 8, lines 43-55), and a coverage mask, the coverage mask indicating which of the plurality of pixels are visible for the current primitive (Col. 33, lines 42-47; Col. 6, lines 28-29).

9. With regard to Claim 5, Voorhies discloses that each compressed z-record (Col. 54, lines 44-55) comprises two minimum z values for the plurality of pixels, two maximum z values for the plurality of pixels (Col. 8, lines 43-55), and a coverage mask, the coverage mask indicating which of the plurality of pixels are visible for the current primitive (Col. 33, lines 42-47; Col. 6, lines 28-29).

10. With regard to Claim 7, a parser is known in the art to be a component of a compiler that forms a data structure, usually a tree, which is suitable for later processing and which captures the implied hierarchy of the input. Voorhies discloses a parser that

forms a tree data structure which is suitable for later processing and which captures the hierarchy of the input (*processing the boxes in near-to-far order, organize polygons into a spatial hierarchy such as an octree*, Col. 9, lines 57-61), and the discarding is performed by a parser (Col. 54, lines 44-55).

11. With regard to Claim 8, Voorhies discloses a method of rendering a plurality of graphic primitives comprising passing, within a graphic pipeline, only a limited portion of the graphic data associated with each primitive, wherein the limited portion of graphic data comprises location-related data (Col. 2, lines 58-67; Col. 6, lines 28-29; Col. 3, lines 16-31); and wherein each primitive comprises a plurality of pixels (*depth samples—depths at pixels*, Col. 6, lines 40-44, *all samples that the primitive covers*, Col. 6, line 66-67-Col. 7, line 3); processing the limited portion of graphic data associated with each individual primitive; determining, for each primitive, whether the primitive has at least one visible pixel; communicating data associated with pixels of primitives determined to have at least one visible primitive to a pixel shader for rendering; and passing and processing, within the pixel shader, the remaining graphic data associated with each primitive only for those primitives determined to have at least one visible pixel, wherein the remaining graphic data includes at least one of the following: lighting, texture, and fog data (Col. 54, lines 44-55; Col. 6, lines 39-43; Col. 16, lines 1-22; Col. 3, lines 16-35 Col. 5, lines 50-53; Col. 6, lines 15-17).

12. With regard to Claim 9, Voorhies discloses setting a visibility indicator for each pixel determined to have at least one visible pixel (Col. 33, lines 42-49).

13. With regard to Claim 13, Voorhies discloses a method of rendering a plurality of graphic primitives (Col. 2, lines 58-67; Col. 6, lines 28-29) comprising passing in a first pass, within a graphic pipeline, only a limited portion of graphic data for each primitive, wherein each primitive comprises a plurality of pixels and wherein the limited portion of graphic data comprises location-related data (Col. 3, lines 16-31; Col. 6, lines 40-44, Col. 6, line 66-67-Col. 7, line 3); processing the limited portion of graphic data to build a compressed z-buffer, the compressed z-buffer comprising a plurality of z-records, each z-record embodying z information for a plurality of pixels (Col. 54, lines 44-55; Col. 6, lines 1-14); in a second pass, within the graphic pipeline, performing a two-level z-test on graphic data, wherein a first level of the z-test compares the graphic data of a current primitive with corresponding information in the compressed z-buffer, and wherein a second level of the z-test is performed on a per-pixel basis in a z-test manner, wherein the second level z-test is performed only on pixels within a record of the compressed z-information in which the first level z-test determines that some but not all pixels of a macropixel (16x16 pixel region) are visible, wherein additional graphic data associated with each primitive is passed into the graphics pipeline on the second pass only for primitives that are at least partially visible (Col. 54, lines 44-55; Col. 6, lines 39-43; Col. 16, lines 1-22; Col. 3, lines 16-35); and communicating data associated with pixels of macropixels determined to be visible to a pixel shader for rendering (Col. 5, lines 50-53; Col. 6, lines 15-17).

14. With regard to Claim 14, Voorhies discloses a graphics processor comprising first-pass logic configured to deliver to a graphic pipeline, in a first pass, only a limited portion of graphic data for each primitive, wherein each primitive comprises a plurality of pixels, wherein the limited portion of graphic data comprises location-related data (Col. 3, lines 16-31; Col. 6, lines 40-44, Col. 6, line 66-67-Col. 7, line 3); logic configured to process the limited portion of graphic data for each primitive to create a compressed z-buffer; logic configured to determine, for each primitive, whether the primitive has at least one visible pixel (Col. 54, lines 44-55; Col. 6, lines 1-14); second-pass logic configured to deliver to the graphic pipeline, in a second pass, the remaining graphic data associated with each primitive for only those primitives determined to have at least one visible pixel, the second-pass logic further configured to inhibit the deliver of graphic data to the graphic pipeline for primitives not determined to have at least one visible pixel (Col. 54, lines 44-55; Col. 6, lines 39-43; Col. 16, lines 1-22; Col. 3, lines 16-35).

15. With regard to Claim 15, a parser is known in the art to be a component of a compiler that forms a data structure, usually a tree, which is suitable for later processing and which captures the implied hierarchy of the input. Voorhies discloses a parser that forms a tree data structure which is suitable for later processing and which captures the hierarchy of the input (Col. 9, lines 57-61), and the first-pass logic and a second-pass logic are contained within a parser (Col. 54, lines 44-55).

16. With regard to Claim 17, Voorhies discloses including logic for setting a visibility indicator for each primitive determined to have at least one visible pixel (Col. 33, lines 42-49).

17. With regard to Claim 19, Voorhies discloses including logic configured to associate each primitive processed in the first pass of the data with a distinct visibility indicator (Col. 33, lines 42-49).

18. With regard to Claim 20, Voorhies discloses including logic configured to evaluate, for each primitive presented for processing in the second pass, a status of the visibility indicator associated with the given primitive (Col. 54, lines 44-55; Col. 46, line 61-Col. 47, line 4).

19. With regard to Claim 21, Voorhies discloses a graphics processor comprising logic configured to pass and process only a portion of graphic data passed into a graphic pipeline for each of a plurality of primitives, in a first pass within the graphic pipeline to determine whether the primitive has at least one visible pixel, wherein each primitive comprises a plurality of pixels; and wherein the graphic data comprises location-related data (Col. 3, lines 16-31; Col. 6, lines 40-44, Col. 6, line 66-67-Col. 7, line 3; Col. 54, lines 44-55; Col. 6, lines 1-14); logic configured to render, in a second pass within the graphic pipeline, only the primitives determined in the first pass to have at least one visible pixel, wherein the remaining portion of graphic data associated with each

primitive is passed into the graphics pipeline on the second pass (Col. 54, lines 44-55; Col. 6, lines 39-43; Col. 16, lines 1-22; Col. 3, lines 16-35).

20. With regard to Claim 23, a parser is known in the art to be a component of a compiler that forms a data structure, usually a tree, which is suitable for later processing and which captures the implied hierarchy of the input. Voorhies discloses a parser that forms a tree data structure which is suitable for later processing and which captures the hierarchy of the input (Col. 9, lines 57-61), and the logic configured to limit the processing of graphic data is within a parser (Col. 54, lines 44-55).

21. With regard to Claim 24, Voorhies discloses including logic configured to build a compressed z-buffer of data from processing of the graphic data in the first pass (Col. 54, lines 44-55; Col. 6, lines 1-14).

22. With regard to Claim 25, Voorhies discloses including logic for setting a visibility indicator for each primitive processed in the first pass (Col. 33, lines 42-49).

23. With regard to Claim 26, Voorhies discloses including logic configured to evaluate the visibility indicator for each primitive prior to submitting the primitive to the logic configured to render in the second pass (Col. 54, lines 44-55; Col. 46, line 61-Col. 47, line 4).

24. Thus, it reasonably appears that Voorhies describes or discloses every element of Claims 1, 4, 5, 7-9, 13-15, 17, 19-21, and 23-26 and therefore anticipates the claims subject.

Claim Rejections - 35 USC § 103

25. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

26. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

27. Claims 3, 6, 10, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Voorhies (US007023437B1) in view of Gannett (US006118452A).

28. With regard to Claim 3, Voorhies is relied upon for the teachings as discussed above relative to Claim 1. Voorhies discloses that the location-related data comprises X, Y, and Z values (Col. 14, lines 22-38).

However, Voorhies does not explicitly teach that the location-related data comprises W values. However, Gannett describes that location-related data comprises X, Y, Z and W values (Col. 1, lines 29-33; Col. 13, lines 50-55).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Voorhies so that the location-related data comprises W values as suggested by Gannett because Gannett suggests that the W value is needed in order to determine the horizontal length of the pixels to render, and the W value is commonly used in typical computer graphics systems (Col. 1, lines 18-33; Col. 13, lines 50-55).

29. With regard to Claim 6, Voorhies does not explicitly teach that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory. However, Gannett describes that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory (*visible pretest module 202 receiving the various clear control commands and values from the frame buffer*, Col. 13, lines 16-19; Col. 14, lines 13-22).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Voorhies so that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory as suggested

by Gannett because Gannett suggests that setting bits in a mask is a quick and efficient way to indicate the visibility (Col. 13, lines 16-19; Col. 14, lines 13-22).

30. With regard to Claim 10, Voorhies does not teach that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory. However, Gannett describes that setting the visibility indicator more specifically comprises setting a bit in a frame buffer memory (Col. 13, lines 16-19; Col. 14, lines 13-22). This would be obvious for the same reasons given in the rejection for Claim 6.

31. With regard to Claim 18, Voorhies does not explicitly teach that the visibility indicator includes a single bit in a frame-buffer memory. However, Gannett describes that the visibility indicator includes a single bit in a frame-buffer memory (Col. 13, lines 16-19; Col. 14, lines 13-22). This would be obvious for the same reasons given in the rejection for Claim 6.

32. Claims 12, 16, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Voorhies (US007023437B1) in view of Griffin (US005990904A).

33. With regard to Claim 12, Voorhies is relied upon for the teachings as discussed above relative to Claim 8. Voorhies describes that the determining whether the primitive has at least one visible pixel ensures that the primitive does not fail a compressed z-buffer test (Col. 54, lines 44-55; Col. 6, lines 1-14), ensures that all pixels of the primitive are not culled *(conditionally avoided based on the monitored performance of the first z-*

culling operations, Col. 3, lines 49-55), and ensures that all pixels of the primitive are not clipped (Col. 12, lines 37-42).

However, Voorhies does not teach ensuring that the primitive does not render to zero pixels. According to the disclosure of this application, a zero-pixel primitive is a primitive that, when rendered, consumes less area than one pixel of visibility [0024]. However, Griffin describes a compressed z-buffer (Col. 9, lines 34-54) and ensuring that the primitive does not render to zero pixels (Col. 2, line 61-Col. 3, line 5; Col. 5, lines 26-42).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify the device of Voorhies to include ensuring that the primitive does not render to zero pixels as suggested by Griffin because Griffin suggests the advantage of being able to perform anti-aliasing to that anomalies such as jaggy edges in the rendered image do not result (Col. 2, line 61-Col. 3, line 5). It would have been obvious to modify the device to include a compressed z-buffer because Griffin suggests the advantage of considerably reducing the amount of data required, allowing practical implementation of a much more sophisticated anti-aliasing algorithm (Col. 9, lines 34-54).

34. With regard to Claims 16 and 22, these claims are each similar in scope to Claim 12, and therefore are rejected under the same rationale.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joni Hsu whose telephone number is 571-272-7785. The examiner can normally be reached on M-F 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JH

U Chauhan

Ulka Chauhan

Supervisory Patent Examiner